Stabilized Incidence in Proximal Humeral Fractures of Elderly Women

Nationwide Statistics from Finland in 1970-2015

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ABSTRACT

Background: Low-trauma fractures of elderly women are a major public health concern

Methods: We determined the current trend in the absolute number and incidence (per 100 000 persons) of fresh low-trauma fractures of the proximal humerus among 80-year-old or older Finnish women by taking into account all women who were admitted to Finnish hospitals for primary treatment of such a fracture between 1970 and 2015.

Results: The number of low-trauma fractures of the proximal humerus among 80-year-old or older Finnish women rose continuously between 1970 (32 fractures) and 2015 (568 fractures), while the age-adjusted fracture rate (showing a clear rise from 87 fractures per 100 000 persons in 1970 to 304 fractures in 1995) became stabilized between 1995 and 2015 (297 fractures per 100 000 persons in 2015).

Conclusions: The clear rise in the incidence of low-trauma proximal humeral fractures in Finnish elderly women from early 1970s until mid 1990s has been followed by stabilized fracture rates. Reasons for this are largely unknown, but a cohort effect toward a healthier aging population with improved functional ability, as well as measures to prevent falls and alleviate fall severity, could partly explain the phenomenon.

INTRODUCTION

Proximal humeral fractures are the third most frequent fracture in elderly people after hip fracture and distal forearm fracture (1,2). More than 70% of patients with a proximal humeral fracture are older than 60 years, about 75% are women, and from 40 years of age the risk of fracture begins to increase exponentially (1-4).

Treatment of proximal humeral fractures is demanding and can be time consuming and costly (1-7). Therefore, detailed knowledge on fracture epidemiology is essential for planning prevention actions and projecting the number of future fractures. Nevertheless, epidemiologic information on proximal humeral fractures is sparse, especially concerning their recent secular trends (1-9).

Previously we reported that the number and age-adjusted incidence of proximal humeral fracture among older Finns clearly rose from the early 1970s to the late 1990s (10) and started to stabilize thereafter (11). We have now followed the highest risk group of fracture, women 80 years of age or older, to the end of 2015 to assess their fracture development in the new millennium.

MATERIALS AND METHODS

In accord with other epidemiologic studies (1,10-13), we defined a low-trauma fracture of the proximal humerus as a fracture occurring as a consequence of low or moderate energy trauma (typically a fall from standing height or less) and collected from the National Hospital Discharge Register (NHDR) all Finnish women 80 years and older who were admitted to our hospitals from 1970 to 2015 for primary treatment of such a fracture. Traffic accidents and other high energy trauma were excluded, as were those with a pathological fracture. In addition, cases with codes identifying trauma or surgery sequelae and orthopedic aftercare were also excluded.

The Finnish NHDR (established in 1967) is the oldest nationwide discharge register in the world, and the data provided are well suited for epidemiologic analyses. This register is well validated covering the acute injuries in the population adequately (annual coverage of injuries is $\geq$ 90%) and recording them accurately (annual accuracy of injury diagnoses is also $\geq$ 90%). This concerns especially severe injuries with clear-cut diagnoses, such as ligament ruptures and bone fractures (14,15).

The diagnoses were labeled with a 5-digit code according to the eighth, ninth, and tenth revisions of the International Classification of Diseases (ICD) that indicated the type of fracture. From 1970–1986, we used the eighth revision of ICD and its two code classes for fractures of the proximal humerus (81200 and 81210). From 1987–1995, the ICD-9 code classes were 8120A and 8121A, and from 1996–2015, the ICD-10 code class was S42.2.

The study consisted of the entire Finnish population (5.5 million people in 2015). Thus, the given absolute numbers and incidence rates of proximal humeral fractures among 80-year-old or older women were not cohort-based estimates but actual results in the respective total population.

Therefore, this study, similar to our previous epidemiologic investigations (10,11,16), did not use statistical analyses with probability values and confidence intervals characteristically needed in cohort or sample-based estimations with sampling variability.

The annual midyear population figures in 1970–2015 and the population prediction until the year 2030 were taken from the Official Statistics of Finland (17,18). In this statutory, computer-based register (The Official Population Register of Finland), every Finn is registered by his or her personal identification number. The register is quality controlled continuously and updated by Statistics Finland, the Central Statistical Office of Finland.

Fracture incidence rates were expressed as the number of cases per 100 000 women per year. In calculating the age-adjusted fracture incidence, age adjustment was done by direct standardization using the mean 80-year-old or older female population between 1970 and 2015 as the standard population.

The predicted absolute number of fractures in 2030 was obtained by multiplying the age-adjusted fracture incidence in 2015 by the estimated number of the 80-year-old or older female population in 2030 (18).

RESULTS

The annual total number of Finnish 80-year-old or older women with a low-trauma proximal humeral fracture rose sharply and steadily during the study period, from 32 in 1970 to 568 in 2015 (Fig 1A). Between 1970 and 1995, the age-adjusted incidence of these fractures also rose (from 87 fractures per 100 000 women in 1970 to 304 fractures per 100 000 women in 1995), but thereafter, the fracture incidence remained rather stable (297 fractures per 100 000 women in 2015) (Fig. 1B).

If the age-adjusted incidence of low-trauma fractures of the proximal humerus among the 80-year-old or older female Finns were to become stabilized to the 2015 level and the size of this population increased as predicted (from 0.18 million in 2015 to 0.30 million in 2030) (18), the number of these fractures in 80-year-old or older female Finnish population would be approximately 60% higher in 2030 (898 fractures) than in 2015 (568 fractures) (Fig. 2).

DISCUSSION

This study assessed for the Finnish female population 80 years of age and older the time trends of the absolute number and incidence of low-trauma proximal humeral fractures from 1970 to 2015. The results showed that the long-term rise in the age-adjusted incidence of these fractures from the early 1970s till the mid 1990s was followed by stabilized fracture rates. In other words, Finland has now faced a clear trend break in the incidence of older women's low-trauma fractures of the proximal humerus. On the other hand, the absolute number of proximal humeral fractures may not be decreasing in the future, because demographic predictions show that the size of the population at risk of these fractures is constantly expanding and will do so more rapidly in the near future (see Fig. 2). In fact, the only way to see a stabilization or true reduction in the number of future fractures would be to see a simultaneous decline in the age-adjusted fracture risk.

Our humerus fracture statistics, which are the very first full-scale nationwide data available from 1970 to 2015, are in line with recent reports on distal humeral, hip, knee and ankle fractures in Finland and elsewhere: the rates of these fractures have also stabilized or even started to decline during the recent decade (19-28).

The precise reasons for the secular change in the risk of low-trauma fractures of elderly people are not known. As speculated previously (25-28), a cohort effect towards healthier elderly populations cannot be ruled out: in earlier birth cohorts, the early-life risk factors for fracture, such as perinatal nutrition, may have had stronger impact on the late-life fracture risk than in the others.

A second reason could be the improved functional ability in the elderly populations in the 1990s (29-33). Poor neuromuscular function is a strong risk factor for humeral and other fractures and any improvement in this predictor, with concomitantly reduced risk for balance loss, slipping, tripping

and fall, is likely to reduce the risk of fracture (29-36).

A third explanation for stabilized fracture rates could basically arise from efforts of recent programs and interventions to prevent falling and minimize fall severity (strength and balance training, reduction in psychotropic medication, proper nutrition, correction of visual impairment such as cataract, podiatric care, modification of home and environmental hazards, systematic patient and staff education, multifactorial fall prevention programs via falls clinics, and use of gait-stabilizing anti-slip devices) (30-33,37,38). However, care must be taken when considering these factors as potential explanation, because there are neither clear signs nor good evidence for their beneficial secular change in Finland, or the factor was so uncommon in our elderly population in 1990s that its role must have been minor in explaining the stabilized fracture incidence (25-28).

Finally, the secular change in fracture risk could be explained by enhanced bone health. In other words, specific actions to prevent and treat osteoporosis (nonsmoking campaigns, exercise, calcium, vitamin D, hormone replacement therapy, and bone-specific drugs) may have started to improve bone mass and strength during the decade of the 1990s. However, the same limitations apply here as noted above for falling and its potential modifiers (30,36).

Only the coming years will show whether the above noted stable situation in the incidence of low-trauma fractures of the proximal humerus continues. However, as calculated above, because the rapid and continuous rise in our aging female population is likely to increase the absolute number of these fractures in the future, intervention studies on potentially cost-effective fracture-preventing measures - such as prevention of slippings, trippings and falls; use of gait-stabilizing, antislip devices; and injury-site protection - should be urgently initiated.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest.

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FIG. 1. The number (A) and age-adjusted incidence (per 100 000 individuals) (B) of proximal humeral fractures in women 80 years of age or older in Finland from 1970 to 2015.

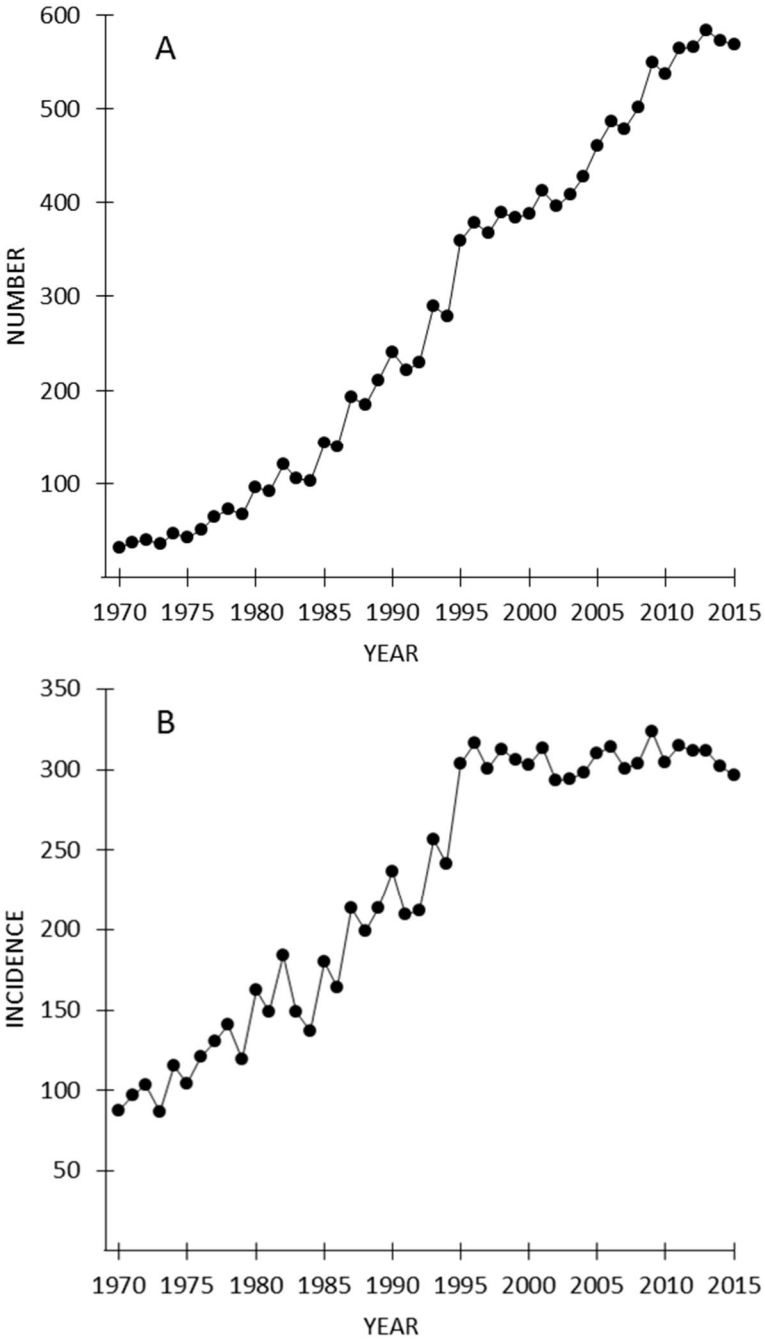

FIG. 2. Actual and predicted numbers of proximal humeral fractures in women 80 years of age or older in Finland between 1970 and 2030. The prediction part of the curve (dashed line) denotes to a fracture development-model in which the age-adjusted incidence of fracture becomes stabilized to the 2015 level. The size of the 80-year-old or older female population is predicted to increase from 0.18 million in 2015 to 0.30 million in 2030.